

Intelligent safety helmet

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1. Introduction

There is an alarming increase in the morbidity and mortality due to two wheeler road traffic accidents. This has been a matter of great concern globally. In India, it is estimated that one accident takes place every 2 minutes. Data from the National Crime Records Bureau indicates that deaths and injuries related to road traffic accident has increased two and four fold respectively during the period of 1991–2005. Reportedly 98,254 persons were killed in 2005 on Indian roads.

The occupants and riders of two wheeler vehicles are among the majority to be affected in road traffic accidents. Two wheeler accidents have also been shown to have maximum case fatality in accidents. One of the prime reasons that leads to accidents is “drunk and drive”. **Due to drinking and driving two wheeler riders often get into accidents.**

Almost 70% of the accidents in our country can be prevented if the riders stop consuming alcohol before riding. The people involved in the accidents need to be taken care of and immediately taken to the emergency room. But there is a lag in handling the aftermath of road accidents in the country. The nearby police station needs to be notified immediately about the accidents so that they can be taken to the hospitals immediately. The proposed system is an intelligent helmet. A module affixed in the helmet, such that, the module will sync with the module affixed on bike and will also ensure that biker has not consumed alcohol. Additional feature of accident detection module will be installed on the bike, which will be able to detect accident and will be able to notify quickly the accident to police control room and in case if the accident is minor, rider can abort message sending by pressing the abort switch. The aim of this project is to make a protection system in a helmet for a good safety of bike rider. The smart helmet that we made is fixed with sensors which act as to detect wear helmet or not. There are two different microcontroller is used in this project. Each unit has used a separate microcontroller, for bike unit we use Arduino LilyPad and for helmet unit we use ARM7 lpc2148. Signal transmission between the helmet unit and bike unit is using a RF concept.

In today's era, especially in the young generation, the craze of motorbikes is really remarkable. And one of the reasons for this accident is alcohol consumption Even though breath analyzers are used to detect whether the rider has consumed alcohol or not by the traffic department, it is difficult to check each and every rider on the road. Most of the deaths will occur since the injured person is not given proper medical attention. In order to overcome the above mentioned problem we are designing an intelligent system that prevents road accident and detects alcohol consumption and also this will be able to detect crash and will be able to notify quickly the accident to predefined number. Despite of the safety rules made by the government, many riders fail to abide by them. The riders in India often bypass the prime rule of wearing the helmet while riding bike. This leads to fatal injuries to the rider in case of accidents. Apart from manual checking, there needs to be a system that could enforce this rule upon the riders and hence prevent them from bypassing it.

This is the GPS based vehicle accident detection and security system. A GPS receiver must be receive the signal of satellites to calculate a position (latitude and longitude) and send the data to Micro controller. All function is done by Micro controller. **MCU read the information of GPS Modem and display on LCD. In the vehicle, has different sensor's like, Acceleration detection, Alcohol detector or vibration sensor etc.** When any sensor detected in vehicle, MCU send location and sensor status VIA SMS to user.

2. Literature Review

Chitte P.P, Mr. Thorat Aniruddha N “Smart Helmet & Intelligent Bike System”. The author explained a smart helmet is a type of protective headgear used by the rider which makes bike driving safer than before. The main purpose of this smart helmet to provide safety for rider. This implement by using advance feature like alcohol detection, accident identification, location tracking, use as a hands free device, solar powered, fall detection. This makes not only smart helmet but also feature of smart bike. Its compulsory to wear helmet, without helmet ignition switch cannot ON. A RF Module as wireless link which able to communicate between transmitter and receiver. If rider getting drunk it gets automatically ignition switch is locked, and send message automatically to their register number with their current location. So when accident occurs, it will send message by GSM to register numbers with their current location by GPS module. It can use to receive call while driving. The distinctive utility of project is fall detection, if the bike rider fall from bike it will send message automatically. The outcomes of the project

have showed that the bike ignition will start if the helmet is worn. So, it will automatically decrease the effect from accident and it can avoid bike from being stolen. Arduino lilypad is good in controlling all the system and the sensors. Executing the wireless system which Radio Frequency Module to send signal from helmet unit to the bike unit. Due to this wireless connection is better than wired link.

Jennifer William, Nexon Samuel “Intelligent Helmet”. The author explained As the bikers in our country are increasing, the road mishaps are also increasing day by day, due to which many casualties, most of them are caused due to most common negligence of not wearing the helmets, and also many deaths occur due to lack of prompt medical attention needed by the injured person. This motivates us to think about making a system which ensures the safety of biker, by making it necessary to wear helmet, as per government guidelines, also to get proper and prompt medical attention, after meeting with an accident. The proposed system is an intelligent helmet. A module affixed in the helmet, such that, the module will sync with the module affixed on bike and will also ensure that biker has not consumed alcohol. Additional feature of accident detection module will be installed on the bike, which will be able to detect accident and will be able to notify quickly the accident to police control room and in case if the accident is minor, rider can abort message sending by pressing the abort switch. Intelligent Helmet ensures the **safety of the rider, by making it necessary to wear helmet, and ensures that the rider hasn't consumed any alcohol.** If any of these prime safety rules are violated, the system will prevent the biker from starting the bike. The system also helps in efficient handling of the aftermath of accidents by sending a SMS with the location of the biker to the police station. This ensures that the victims get proper and prompt medical attention, if met with an accident.

Devendra Itole , Aakash Menon, “Intelligent Helmet”. The author explained Nowadays almost all countries are making the use of helmets mandatory and cracking down strictly on drunken driving. But still in many places, the rules are being violated. In order to overcome this problem, a system named –Intelligent Helmet|| is proposed in this paper. A smart helmet is a special idea which makes motorcycle driving safer. The proposed system describes the interaction between modules mounted on the vehicle and helmet to ensure the vehicle can be started only when the user is wearing a helmet and is not under the influence of alcohol. Another feature of the proposed system is the ability to detect an accident and send the corresponding geographical coordinates of the accident spot to predefined numbers using a GPS and GSM system respectively. After giving an overview of the system, the paper describes the system architecture, specific components used, logic flow employed and benefits of the system. This proposed system aims at making safety the norm and not a choice. A system for intelligent helmet has thus been developed which, through communication between a module in the helmet and one on the vehicle ensures various safety aspects. This system also detects the occurrence of an accident and makes provisions to sound an alert through the use of a GPS and GSM system. This system ensures the pre-requisite conditions to ride safely, namely, wearing a helmet and not riding under the influence of alcohol, are fulfilled. The accident alert feature also arranges for timely help to be provided. The use of GPS system specifically benefits if an accident occurs in a secluded area or at an odd hour. The features of the proposed system can be further extended to place a call to an ambulance when an accident occurs and play a voice message indicating the location. This can reduce the time required for emergency help.

3. System Descriptions

3.1. Background Theory

Everyone in the modern world has gadgets. The center piece of every electronic ecosystem is the Smartphone. All these gadgets are driven by data. Traditionally, usage of these devices in vehicles has resulted in an increasing number of accidents and has thus been banned in many places. The proposed Smart Helmet conforms strictly to most traffic regulations and is street safe. The design is not fidgety, with minimal physical user interaction. The system uses voice recognition to control the system in-ride. Phone calls are ignored by default. Cumulatively this results in a system that is safe, extremely useful to the user and meets government regulations at the same time.

Road safety and its subsidiaries involved not just technological proves but also involves there aspect of human behavior in times when the individual needs to have their reflexes as good as an athlete or an individual that has had training in carrying a military operations, in order to survive. Since **most of the general populations isn't actively involved in the process of improving reflexes** it is the responsibility of the technology developers to come up with solutions that less human involvement but also provide the user with some more time to a situation that may involve fatality. The road safety operations in our country do not the level of involve training and consultation that are required for the demographic that the people of our nation make up which is why India happens to see a large number of road accidents every year and the statistics only consolidate the theory of there being a need for a better alternative to just a regular head protection device for people of a country where the majority cannot afford the safety that comes with being on four wheels and inside a cabin.

The rise of the Internet of Things has changed the way people react with their surroundings and this project sheds light on the same and helps improve the workings of how human interaction happens during times of quick responses and makes us less careless about how we commute thereby helping us improve the safety of ourselves and the people around us. The possibility of an individual making a mistake while riding a two wheeler under the influence of alcohol has been known to increase drastically and thus this project will help us not only spread awareness about it, but also attempt to eliminate the possibility of driving under the influence of substances.

3.2. Block Diagram

In this chapter we shall discuss the details of the functioning of the helmet with the help of a block diagram as shown in figure 4 below that takes into account all the important components of the technology that will constitute the end product.

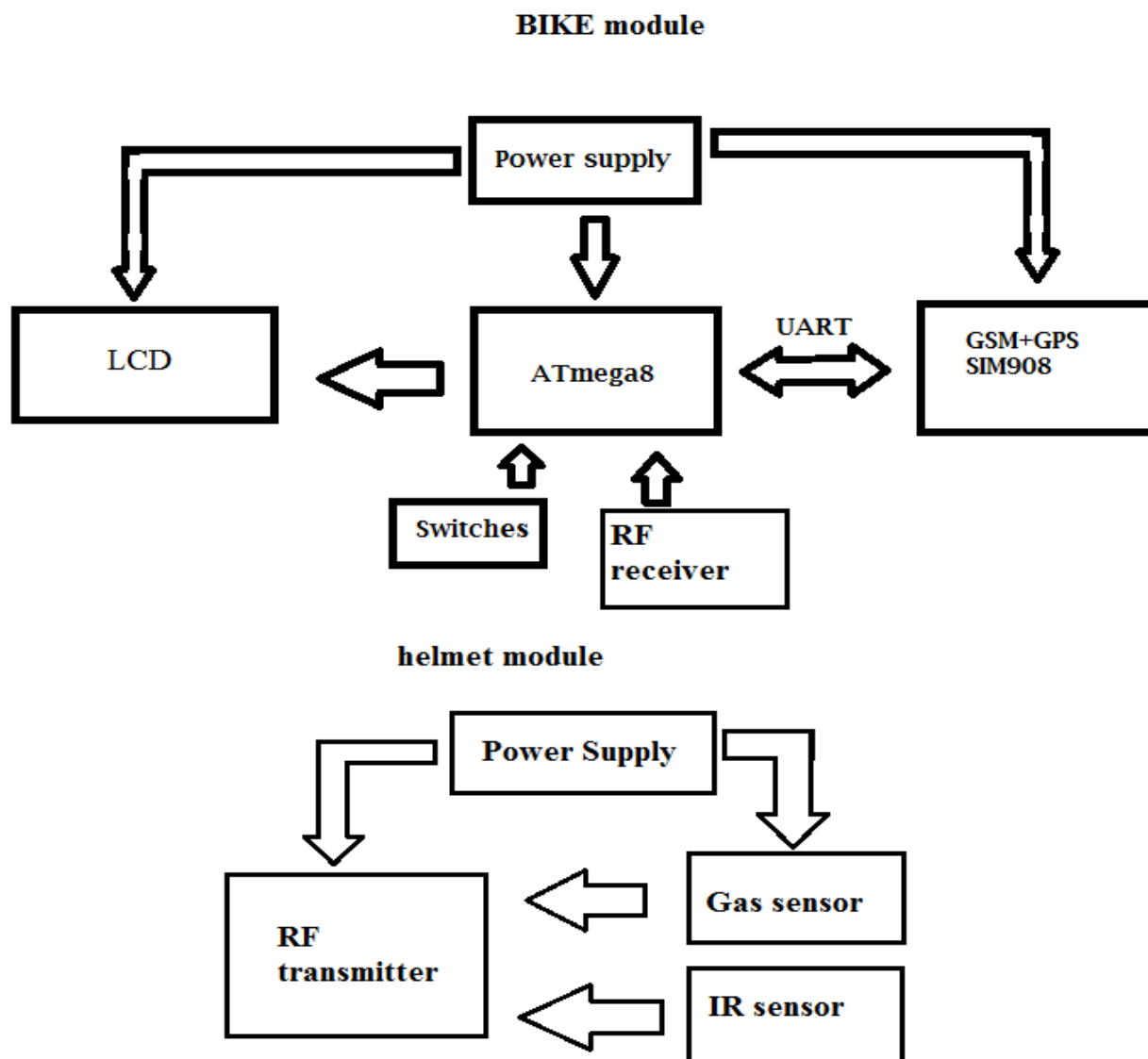


Figure 3.2. Block Diagram

Here we see that the device involves the use of multiple sensors which monitor the motion, inclination, alcohol detection levels and also tracks and transmits the location of the device. The LCD screen helps provide valuable information to the user wearing the helmet and is used as a very valuable information center for the device if multiple utility functions need to be added later.

3.3. DESCRIPTION OF BLOCK DIAGRAM

3.3.1 Transmitter section:

Transmitter section contains helmet switch, alcohol sensor, encoder, RF transmitter and antenna.

1. Helmet switch

This is a small switch inside the controller connected to the full on power and full off brake. Gives positive contact, and eliminates the resistor from the circuit. A very efficient way of handling power, even in the newer electronic controllers.

2. Alcohol sensor

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration.

3. Encoder

The 212 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/ data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal.

4. RF transmitter

TWS-434 is extremely small and is excellent for applications requiring short range RF remote controls. The transmitter module is only 1/3 the size of a standard postage stamp, and can easily be placed inside a small plastic enclosure. The transmitter output is up to 8mW at 433.92MHz with a range of approximately 400 foot. The TWS-434 transmitter accepts both linear and digital inputs, can operate from 1.5 to 12 Volts- DC, and makes building a miniature hand-held RF transmitter very easy. The TWS-434 is approximately the size of a standard postage stamp.

Receiver section:

Receiver section contains RF receiver, decoder, panic button, bumper switch, LCD display, microcontroller, RS232 communication, and GSM modem and power supply.

5. RF receiver

The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The RWS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs.

6. Decoder

The 212 decoders are a series of CMOS LSIs for remote control system applications. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 2 12 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium.

7. Bumper and panic switch

Tactile Bump Sensors are great for collision detection, but the circuit itself also works fine for user buttons and switches as well.

There are many designs possible for bump switches, often depending on the design and goals of the robot itself. But the circuit

remains the same. They usually implement a mechanical button to short the circuit, pulling the signal line high or low. Panic button is used to give signal to the GSM modem which sends a message to predefined number.

8. Microcontroller

The Atmega8 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In System Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

9. LCD display

Liquid crystal Display (LCD) displays temperature of the measured element, which is calculated by the microcontroller. CMOS technology makes the device ideal for application in hand held, portable and other battery instruction with low power consumption.

10. Serial communication

MAX 232: The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. The MAX232 was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic.

11. GSM modem

The Global System for Mobile Communications (GSM) is the most popular standard

For mobile phones in the world. It is the European standard for digital cellular service that includes enhanced features. It is based on TDMA technology and is used on 850/1900 MHz this is a powerful GSM/GPRS Terminal with compact and self-contained unit. This has standard connector

Interfaces and has an integral SIM card reader.

12. Power supply

It consists of a two regulating IC 7805 and a bridge rectified and it provides a regulated supply approximately 5V.

3.4. Working of the Project

The system ensures the safety of the biker, by making it necessary to wear the Helmet, as per the government guidelines, also to get proper and prompt medical attention, after meeting with an accident. A module is affixed in the helmet, such that, the rider can trigger voluntary messages as well as monitors the motion of the rider and the rate at which the motion takes place. The system will bear following functionalities:

It will ensure that the rider has worn the helmet and the device is turned on. It will also ensure that biker has not consumed alcohol. It will automatically trigger an alert message that will notify the pre-programmed contact. An accident detection module will be installed on the bike, which will be able to detect accident and will be able to notify quickly the accident to police control room and in case if the accident is minor, rider can abort message sending by pressing the abort switch. Data from the helmet will be transmitted wirelessly. According to the various sensor input the micro-controller will decide the actions of other blocks.

A smart helmet is an innovative concept which makes motorcycle driving safer than before. It uses the GPS and GSM as its core technologies. The mechanism of this smart helmet is very simple, vibration sensors are placed in different sections of helmet where the chances of hitting is more which are connected to microcontroller board. So when the rider crashes and the helmet hit the ground, these sensors sense and provide it to the microcontroller board, then controller extract GPS data using the GPS module that is integrated to it. When the data goes below the minimum stress limit then GSM module automatically sends alerting message to ambulance or family members. The hardware used in this system is alcohol sensor, GSM, GPS, microcontroller, pressure sensor and vibration sensor. The system automatically checks whether the person is wearing the helmet and has non-alcoholic breath while driving. There is a transmitter at the helmet and a receiver at the bike. There is a switch used to sure the wearing of helmet on the head. The data to be transferred is coded with RF encoder and transmitted

through radio frequency transmitter. The receiver at the bike collects the data and decodes it through RF decoder. MCU controls the function of relay and thus the ignition; it controls the engine through a relay and a relay interfacing circuit.

3.5. Applications

1. We can implement various bioelectric sensors on the helmet to measure various activities.
2. We can use small camera for the recording the drivers activity.
3. It can be used for passing message from the one vehicle to another vehicle by using wireless transmitter.
4. We can use solar panel for helmet power supply by using same power supply we can Charge our mobile.

3.6. Proposed methodology

The Proposed methodology of our project is briefly explained below:

1. Project Plan: First we shall determine the project objective and its vision for the future.
2. Block diagram designing: We shall then determine a flowchart that describes the functioning of the device and the flow in which it takes place.
3. Study of Components: A complete study of the components being used must be carried out to.
4. Market survey for components: A survey to determine various factors of the project both social and economical will be taken into account to determine the importance of this product in the market.
5. Circuit designing we must further go about designing the circuit of the device.
6. Circuit testing on bred board the components must then be tested on a bread board before it is finalized.
7. PCB testing: The same circuit design shall then be tested on a PCB board.
8. Components soldering and assembling: After the tests are complete the components can be then soldered and put together on the board.
9. Hardware testing: We shall then check the individual components to see if they function correctly on their own.
10. Micro controller programming: We must then program the microcontroller to perform its various functions.
11. Testing and troubleshooting: On Completion of the assembly, we must then test and troubleshoot the device to eliminate possibility of error during use.

4. Hardware Explanation

The name of the hardware that we will be using in this project is detailed with illustrations. Given name of hardware are the basic that we found mandatory, some more components could be need if required.

4.1. ARDUNO UNO

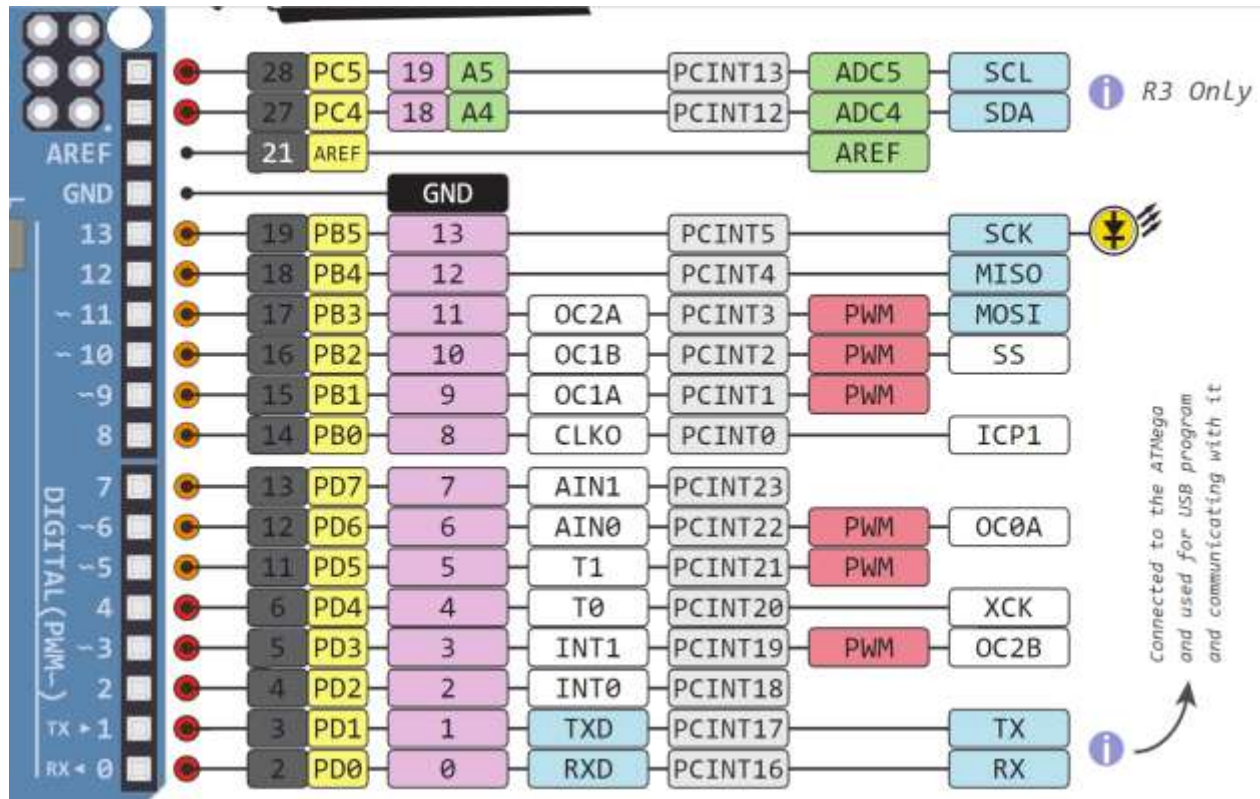


Figure 4.1. ARDUNO UNO INTERFACE

The communication between the micro controller and the GPS receiver and GSM Module requires an ARDUNO UNO interface as shown above in figure 6.1 which serves to convert the CMOS TTL output voltage of the micro controller (0-5 volt) into a voltage of +/- 12 volt. The converter uses the MAX232 (U3) converter IC. The connection of MAX232 to the GPS and GSM uses the RS232 data cable.

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other.

The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R₁ & R₂) can accept ±30V inputs. The drivers (T₁ & T₂), also called transmitters, convert the TTL/CMOS input level into RS232 level.

4.2. Micro controller ATMEGA8

PIC (usually pronounced as "pick") is a family of microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller, then it was corrected as Programmable Intelligent Computer. The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems.

Early models of PIC had read-only memory (ROM) or field-programmable EPROM for program storage, some with provision for erasing memory. All current models use flash memory for program storage, and newer models allow the PIC to reprogram itself. Program memory and data memory are separated. Data memory is 8-bit, 16-bit, and, in latest models, 32-bit wide.

Program instructions vary in bit-count by family of PIC, and may be 12, 14, 16, or 24 bits long. The instruction set also varies by model, with more powerful chips adding instructions for digital signal processing functions.

The hardware capabilities of PIC devices range from 6-pin SMD, 8-pin DIP chips up to 144-pin SMD chips, with discrete I/O pins, ADC and DAC modules, and communications ports such as UART, I2C, CAN, and even USB. Low-power and high-speed variations exist for many types. PIC16 features a 14-bit wide code memory, and an improved 8-level deep call stack. The instruction set differs very little from the baseline devices, but the two additional opcode bits allow 128 registers and 2048 words of code to be directly addressed. There are a few additional miscellaneous instructions, and two additional 8-bit literal instructions, add and subtract. The mid-range core is available in the majority of devices labeled PIC12 and PIC16.

The first 32 bytes of the register space are allocated to special-purpose registers; the remaining 96 bytes are used for general-purpose RAM. If banked RAM is used, the high 16 registers (0x70–0x7F) are global, as are a few of the most important special-purpose registers, including the STATUS register which holds the RAM bank select bits. (The other global registers are FSR and INDF, the low 8 bits of the program counter PCL, the PC high preload register PCLATH, and the master interrupt control register INTCON.) The PCLATH register supplies high-order instruction address bits when the 8 bits supplied by a write to the PCL register, or the 11 bits supplied by a GOTO or CALL instruction, is not sufficient to address the available ROM space.

The PIC architecture is characterized by its multiple attributes:

1. Separate code and data spaces (Harvard architecture).
2. Except PIC32: The MIPS M4K architecture's separate data and instruction paths are effectively merged into a single common address space by the System Bus Matrix module.
3. A small number of fixed-length instructions
4. Most instructions are single-cycle (2 clock cycles, or 4 clock cycles in 8-bit models), with one delay cycle on branches and skips.
5. One accumulator (W0), the use of which (as source operand) is implied (i.e. is not encoded in the opcode)
6. All RAM locations function as registers as both source and/or destination of math and other functions.
7. A hardware stack for storing return addresses
8. A small amount of addressable data space (32, 128, or 256 bytes, depending on the family), extended through banking
9. Data-space mapped CPU, port, and peripheral registers
10. ALU status flags are mapped into the data space
11. The program counter is also mapped into the data space and writable (this is used to implement indirect jumps).

There is no distinction between memory space and register space because the RAM serves the job of both memory and registers, and the RAM is usually just referred to as the register file or simply as the registers. PICs have a set of registers that function as general-purpose RAM. Special-purpose control registers for on-chip hardware resources are also mapped into the data space. The addressability of memory varies depending on device series, and all PIC devices have some banking mechanism to extend addressing to additional memory. Later series of devices feature move instructions, which can cover the whole addressable space, independent of the selected bank. In earlier devices, any register move had to be achieved through the accumulator.

To implement indirect addressing, a "file select register" (FSR) and "indirect register" (INDF) are used. A register number is written to the FSR, after which reads from or writes to INDF will actually be from or to the register pointed to by FSR. Later devices extended this concept with post- and pre- increment/decrement for greater efficiency in accessing sequentially stored data. This also allows FSR to be treated almost like a stack pointer (SP). External data memory is not directly addressable except in some PIC18 devices with high pin count. The code space is generally implemented as on-chip ROM, EPROM or flash ROM. In general, there is no provision for storing code in external memory due to the lack of an external memory interface. The exceptions are PIC17 and select high pin count PIC18 devices.

All PICs handle (and address) data in 8-bit chunks. However, the unit of addressability of the code space is not generally the same as the data space. For example, PICs in the baseline (PIC12) and mid-range (PIC16) families have program memory addressable in the same word size as the instruction width, i.e. 12 or 14 bits respectively. In contrast, in the PIC18 series, the program memory is addressed in 8-bit increments (bytes), which differ from the instruction width of 16 bits. In order to be clear, the program memory capacity is usually stated in number of (single-word) instructions, rather than in bytes.

PICs have a hardware call stack, which is used to save return addresses. The hardware stack is not software-accessible on earlier devices, but this changed with the 18 series devices. Hardware support for a general-purpose parameter stack was lacking in early series, but this greatly improved in the 18 series, making the 18 series architecture more friendly to high-level language compilers.

PIC's instructions vary from about 35 instructions for the low-end PICs to over 80 instructions for the high-end PICs. The instruction set includes instructions to perform a variety of operations on registers directly, the accumulator and a literal constant or the accumulator and a register, as well as for conditional execution, and program branching.

Some operations, such as bit setting and testing, can be performed on any numbered register, but bi-operand arithmetic operations always involve W (the accumulator), writing the result back to either W or the other operand register. To load a constant, it is necessary to load it into W before it can be moved into another register. On the older cores, all register moves needed to pass through W, but this changed on the "high-end" cores.

PIC cores have skip instructions, which are used for conditional execution and branching. The skip instructions are "skip if bit set" and "skip if bit not set". Because cores before PIC18 had only unconditional branch instructions, conditional jumps are implemented by a conditional skip (with the opposite condition) followed by an unconditional branch. Skips are also of utility for conditional execution of any immediate single following instruction. It is possible to skip instructions. For example, the instruction sequence "skip if A; skip if B; C" will execute C if A is true or if B is false.

The 18 series implemented shadow registers, registers which save several important registers during an interrupt, providing hardware support for automatically saving processor state when servicing interrupts.

In general, PIC instructions fall into five classes:

1. Operation on working register (WREG) with 8-bit immediate ("literal") operand. E.g. `movlw` (move literal to WREG), `andlw` (AND literal with WREG). One instruction peculiar to the PIC is `retlw`, load immediate into WREG and return, which is used with computed branches to produce lookup tables.
2. Operation with WREG and indexed register. The result can be written to either the Working register (e.g. `addwf reg,w`) or the selected register (e.g. `addwfreg,f`).
3. Bit operations. These take a register number and a bit number, and perform one of 4 actions: set or clear a bit, and test and skip on set/clear. The latter are used to perform conditional branches. The usual ALU status flags are available in a numbered register so operations such as "branch on carry clear" are possible.
4. Control transfers. Other than the skip instructions previously mentioned, there are only two: `goto` and `call`.
5. A few miscellaneous zero-operand instructions, such as `return` from subroutine, and `sleep` to enter low-power mode.

The PIC architecture was among the first scalar CPU designs and is still among the simplest and cheapest. The Harvard architecture, in which instructions and data come from separate sources, simplifies timing and microcircuit design greatly, and this benefits clock speed, price, and power consumption. The PIC instruction set is suited to implementation of fast lookup tables in the program space. Such lookups take one instruction and two instruction cycles. Many functions can be modeled in this way. Optimization is facilitated by the relatively large program space of the PIC (e.g. 4096×14 -bit words on the 16F690) and by the design of the instruction set, which allows embedded constants. For example, a branch instruction's target may be indexed by W, and execute a "RETLW", which does as it is named – return with literal in W.

Interrupt latency is constant at three instruction cycles. External interrupts have to be synchronized with the four-clock instruction cycle, otherwise there can be a one instruction cycle jitter. Internal interrupts are already synchronized. The constant interrupt latency allows PICs to achieve interrupt-driven low-jitter timing sequences. An example of this is a video sync pulse generator. This is no longer true in the newest PIC models, because they have a synchronous interrupt latency of three or four cycles.

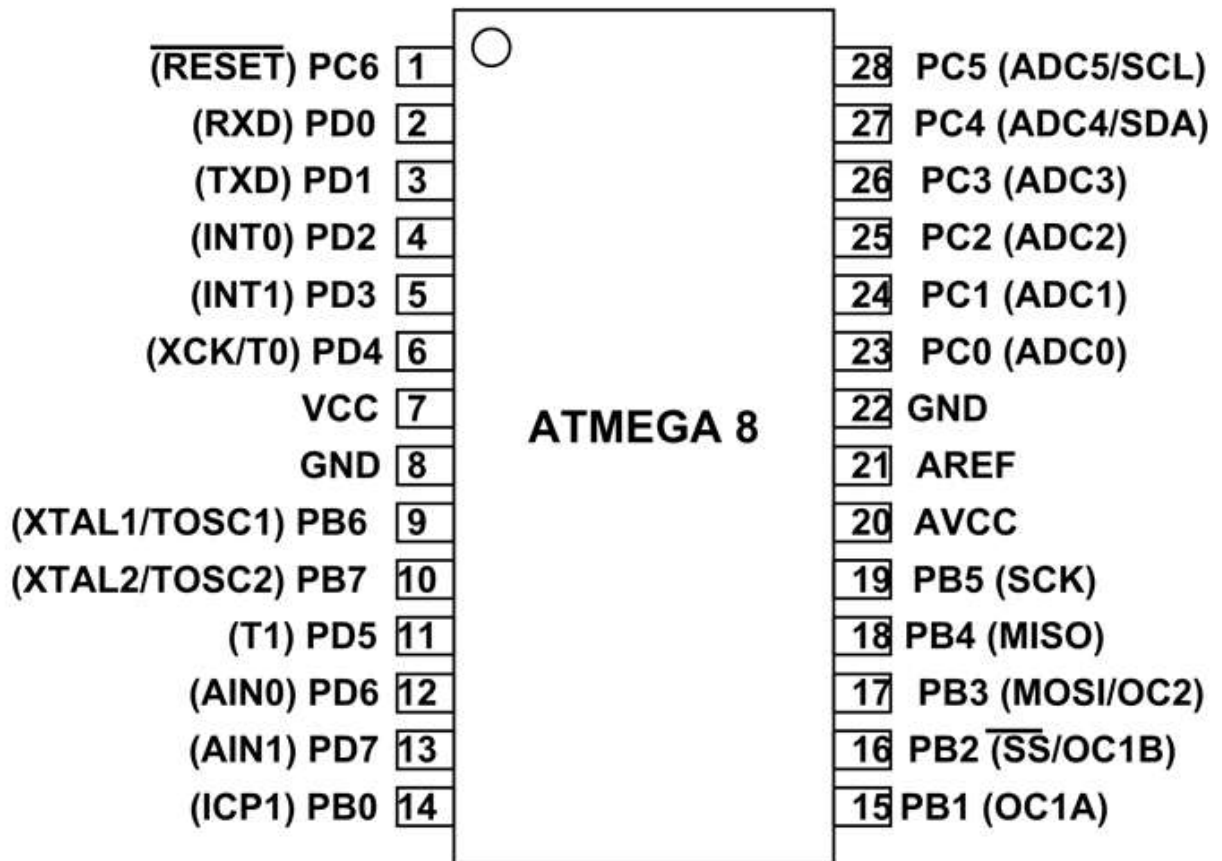


Figure 4.2. Micro controller ATMEGA8

PIC (Peripheral interface controller) is the IC while was enveloped to control the peripheral device, dispersing the function of the main CPU. PIC has the calculation function and the memory like the CPU and is controlled by the software. However the throughput, the memory capacity isn't big. It depends on kind of PIC but the maximum operation clock frequency is about 20MHz and the memory capacity to write the program is about 1K to 4K words. The clock frequency is related with the speed to read the program and to execute the instruction. Only at the clock frequency, the throughput cannot be judged. It changes with the architecture in the processing parts for same architecture; the one with the higher clock frequency is higher about the throughput.

The point, which the PIC convenient for is that the calculation part, the memory, the input/output part and so on, are incorporated into one piece of the IC. The efficiency, the function is limited but can compose the control unit only by the PIC even if it doesn't combine the various IC's so, the circuit can be compactly made.

4.2.1 Special Micro controller Features:

1. High performance RISC CPU.
2. Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle.
3. 2 ~ 4K FLASH Program Memory.
4. 128 bytes of Data Memory (RAM).
5. 10-bit multi-channel Analog-to-Digital converter.

6. Power-on Reset (POR).
7. Power-up Timer (PWRT) and Oscillator Start-up Timer (OST).
8. Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation.
9. Programmable code protection.
10. Power saving SLEEP mode.
11. Selectable oscillator options.
12. Low power, high speed CMOS FLASH / EEPROM technology.
13. Fully static design.
14. Single 5V In-Circuit Serial Programming capability.
15. Wide operating voltage range: 2.0V to 5.5V.
16. High Sink/Source Current: 25 mA.
17. Commercial, Industrial and Extended temperature ranges.
18. Low-power consumption.

4.3. Light Emitting Diode (LED)



Figure 4.3 Light Emitting Diode (LED)

A light-emitting diode (LED), is an electronic light source. Luminescence from an electrically stimulated crystal had been observed as early as 1907. The LED was introduced as a practical electronic component in 1962. All early devices emitted low-intensity red light, but modern LEDs are available across the visible, ultraviolet and infra red wavelengths, with very high brightness.

LEDs are based on the semiconductor diode. When the diode is forward biased (switched on), electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the color of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm²) with integrated optical components to shape its radiation pattern and assist in reflection.

LEDs present many advantages over traditional light sources including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching. However, they are relatively expensive and require more precise current and heat management than traditional light sources.

Applications of LEDs are diverse. They are used as low-energy indicators but also for replacements for traditional light sources in general lighting, automotive lighting and traffic signals. The compact size of LEDs has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in communications technology.

4.4. Crystal Oscillator



Figure 4.4. Crystal oscillator

A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. There are different types of oscillator electronic circuits such as Linear oscillators – Hartley oscillator, Phase-shift oscillator, Armstrong oscillator, Clapp oscillator, Colpitts oscillator, and so on, Relaxation oscillators – Royer oscillator, Ring oscillator, Multivibrator, and so on, and Voltage Controlled Oscillator (VCO). In this article, let us discuss in detail about Crystal oscillator like what is crystal oscillator, crystal oscillator circuit, working, and use of crystal oscillator in electronic circuits. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters/receivers.

4.5. GSM Modem

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. GSM are a mobile communication modem; it stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

There are various cell sizes in a GSM system such as macro, micro, Pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, Pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.



Figure 4.5. GSM Modem

Features of GSM Module:

- Improved spectrum efficiency
- International roaming
- Compatibility with integrated services digital network (ISDN)
- Support for new services.
- SIM phonebook management
- Fixed dialing number (FDN)
- Real time clock with alarm management
- High-quality speech
- Uses encryption to make phone calls more secure
- Short message service (SMS)

Working of GSM Module:

From the below circuit, a GSM modem duly interfaced to the MC through the level shifter IC Max232. The SIM card mounted GSM modem upon receiving digit command by SMS from any cell phone send that data to the MC through serial communication. While the program is executed, the GSM modem receives command 'STOP' to develop an output at the MC, the contact point of which are used to disable the ignition switch. The command so sent by the user is based on an intimation received by him through the GSM modem 'ALERT' a programmed message only if the input is driven low. The complete operation is displayed over 16x2 LCD display.

4.6. GPS Modem

Global Positioning System (GPS) satellites broadcast signals from space that GPS receivers as depicted in figure 6.6 below, use to provide three-dimensional location (latitude, longitude, and altitude) plus precise time. GPS receivers provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth. ultra-sensitive GPS receiver can acquire GPS signals from 65 channels of satellites and output position data with high accuracy in extremely challenging environments and under poor signal conditions due to its active antenna and high sensitivity. The GPS receiver's -160dBm tracking sensitivity allows continuous position coverage in nearly all application environments. GPS is a "constellation" of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Accuracy can be pinpointed to within one meter with special military-approved equipment. GPS equipment is

widely used in science and has now become sufficiently low-cost so that almost anyone can own a GPS and many do in a smart phone, tablet or GPS navigation device.

The output is serial data of 9600 baud rate which is standard NMEA 0183 v3.0 protocol offering industry standard data messages and a command set for easy interface to mapping software and embedded devices.



Figure 4.6. GPS Modem

4.6.1. Features of GPS Modem:

1. High sensitivity -160dBm.
2. Searching up to 65 Channel of satellites.
3. LED indicating data output
4. Low power consumption
5. GPS L1 C/A Code
6. Supports NMEA0183 V 3.01 data protocol
7. Real time navigation for location based services
8. Works from +12V DC signal and outputs 9600 bps serial data
9. Magnetic base active antenna for vehicle rooftop installation

4.7. LM7805

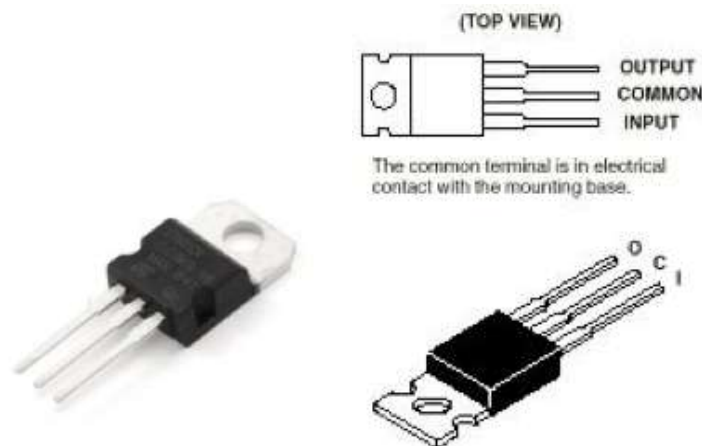


Figure 4.7. LM7805 (3 terminal voltage regulator)

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink. This is used to make the stable voltage of +5V for circuits. The LM7805 is three terminal positive regulators are available in the TO-220 - package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators.

7805 IC Rating

- Input voltage range 7V- 35V
- Current rating $I_c = 1A$
- Output voltage range $V_{Max}=5.2V, V_{Min}=4.8V$

Table No. 4.7.1 Pin description of voltage regulator IC

Pin No.	Pin	Function	Description
1	INPUT	Input voltage (7V-35V)	In this pin of the IC positive unregulated voltage is given in regulation.
2	GROUND	Ground (0V)	In this pin where the ground is given. This pin is neutral for equally the input and output.
3	OUTPUT	Regulated output; 5V (4.8V-5.2V)	The output of the regulated 5V volt is taken out at this pin of the IC regulator.

There is a significant difference between the input voltage & the output voltage of the voltage regulator. This difference between the input and output voltage is released as heat. The greater the difference between the input and output voltage, more the heat generated. If the regulator does not have a heat sink to dissipate this heat, it can get destroyed and malfunction. Hence, it is advisable to limit the voltage to a maximum of 2-3 volts above the output voltage. So, we now have 2 options. Either design your circuit so that the input voltage going into the regulator is limited to 2-3 volts above the output regulated voltage or place an appropriate heatsink, that can efficiently dissipate heat.

4.8. MAX232

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. $\pm 7.5 V$) from a single + 5 V supply via on-chip charge pumps and external capacitors. The MAX232 is an integrated circuit first created in 1987 by Maxim Integrated Products that converts signals from a TIA-232 (RS-232) serial port to signals suitable for use in TTL-compatible digital logic circuits. The MAX232 is a dual transmitter / dual receiver that typically is used to convert the RX, TX, CTS, RTS signals.

The drivers provide TIA-232 voltage level outputs (about ± 7.5 volts) from a single 5-volt supply by on-chip charge pumps and external capacitors. This makes it useful for implementing TIA-232 in devices that otherwise do not need any other voltages.

The receivers reduce TIA-232 inputs, which may be as high as ± 25 volts, to standard 5 volt TTL levels. These receivers have a typical threshold of 1.3 volts and a typical hysteresis of 0.5 volts.



Figure 4.8. Max232 IC

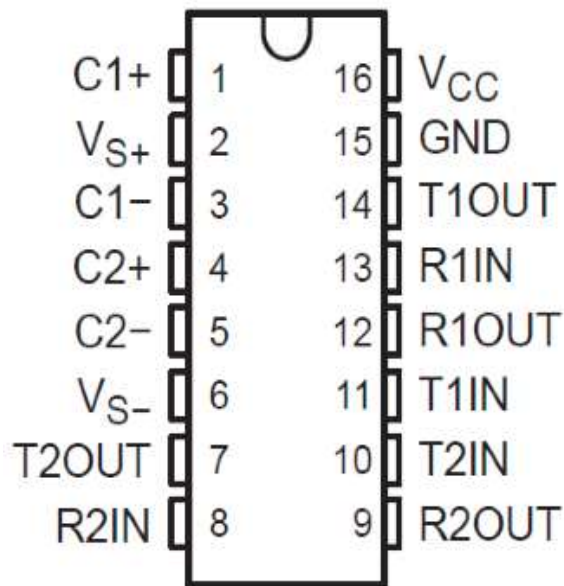


Figure 4.8.1. MAX232 Pin Configuration

The MAX232 (A) has two receivers that convert from RS-232 to TTL voltage levels, and two drivers that convert from TTL logic to RS-232 voltage levels. As a result, only two out of all RS-232 signals can be converted in each direction. Typically, the first driver/receiver pair of the MAX232 is used for TX and RX signals, and the second one for CTS and RTS signals. There are not enough drivers/receivers in the MAX232 to also connect the DTR, DSR, and DCD signals. Usually, these signals can be omitted when, for example, communicating with a PC's serial interface, or when special cables render them unnecessary. If the DTE requires these signals, a second MAX232 or some other IC from the MAX232 family can be used.

4.9. 16 x 2 LCD Modules



Figure 4.9.. LCD display

LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16x2 LCD display is a very basic module commonly used in DIYs and circuits. The 16x2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5x7 pixel matrix. A 16 x 2 LCD controller is one of the most common dot matrix liquid crystal display (LCD) display controllers available. Hitachi developed the microcontroller specifically to drive alphanumeric LCD display with a simple interface that could be connected to a general purpose microcontroller or microprocessor. Many manufacturers of displays integrated the controller with their product making it the informal standard for this type of displays. The device can display ASCII characters, and some symbols in two 16 character lines.

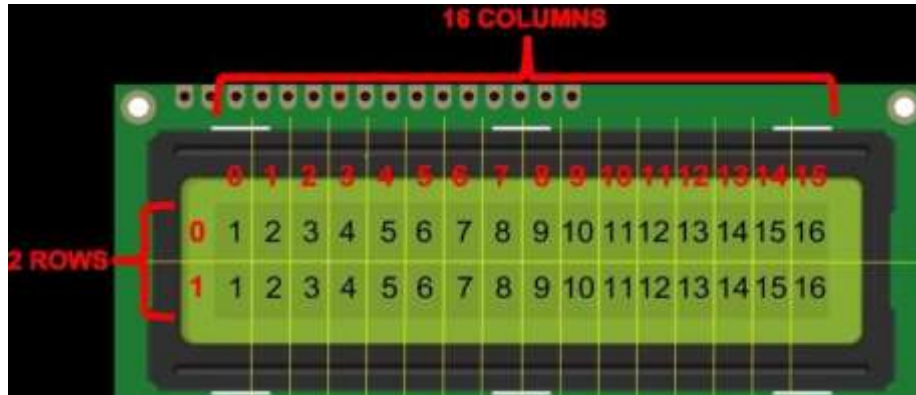


Figure 4.9.1. 16X2 LCD pin out diagram

Table No 4.9.1. Pin description of LCD display

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; the best way is to use variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.	Vo / VEE
4	Selects command register when low, and data register when high	RS (Register Select)
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction we make it high en=1 for some milli seconds. After this we again make it ground that is, en=0.	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2

10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight VCC (5V)	Led+
16	Backlight Ground (0V)	Led-

Register select

A 16X2 LCD has two registers, namely, command and data. The register select is used to switch from one register to other. RS=0 for command register, whereas RS=1 for data register.

Command Register: The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. Processing for commands happen in the command register.

Data Register: The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. When we send data to LCD it goes to the data register and is processed there. When RS=1, data register is selected.

Generating custom characters on LCD is not very hard. It requires the knowledge about custom generated random access memory (CG-RAM) of LCD and the LCD chip controller. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 byte providing the option of creating eight characters at a time. Each character is eight byte in size.

CG-RAM address starts from 0x40(Hexadecimal) or 64 in decimal. We can generate custom characters at these addresses. Once we generate our characters at these addresses, now we can print them on the LCD at any time by just sending simple commands to the LCD.

4.10. Alcohol Sensor Module

This module is made using Alcohol Gas Sensor MQ3. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO₂, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. This is an Arduino Alcohol sensor. It uses a mq3 probe which can be used in a Breathalyzer. It has a high sensitivity to alcohol and less sensitivity to Benzene. The sensitivity is able to be adjusted by the potentiometer It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, and Raspberry Pi etc.



Figure 4.10 Alcohol Sensor Modules

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC. Some features of alcohol sensor are output sensitivity is adjustable, low cost and fast response. Good sensitivity to alcohol gas. It provides both digital and analog output.

Features

- 5V operation
- Simple to use
- LEDs for output and power
- Output sensitivity adjustable
- Analog output 0V to 5V
- Digital output 0V or 5V
- Low Cost
- Fast Response
- Stable and Long Life
- Good Sensitivity to Alcohol Gas
- Both Digital and Analog Outputs
- On-board LED Indicator

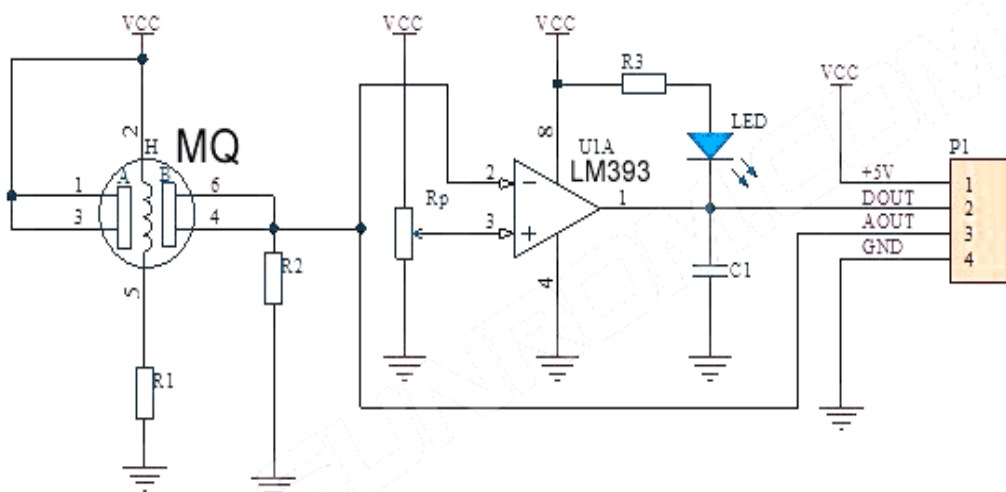


Figure no 4.10.1 Board Schematic for Alcohol Sensor Module

4.11 Sensor Interface

A maximum of 4 sensors can be connected to the system, these can be found in the circuit diagram. These sensors need to have their contacts open when in the inactive state (i.e. normally open) or active low signal @ 5V DC. A power supply voltage of +5 VDC is available for each sensor at the corresponding wiring terminals (CN2). There are many type of sensor available you can connect with the projects. External detection Sensor's interface to micro controller via Port, RA0 to RA3, (pin no 2 to 5). Port RA Used as a digital Input Port and is pulled up via 10K resistors network (R-pack – RN2). Sensor interfaces are a core competence of ams. Sensor Interface ICs allow to readout the information coming from the signal generated by complex sensors, providing a suitable output signal simple to display or elaborate. ams Sensor Interfaces provide high accuracy, precision and sensitivity even in harsh environment. The Simple Sensor Interface (SSI) protocol is a simple communications protocol designed for data transfer between computers or user terminals and smart sensors. The SSI protocol is an Application layer protocol as in the OSI model.

The SSI protocol has been developed jointly by Nokia, Vaisala, Suunto, Ionific, Mermit and University of Oulu. Currently SSI is being developed within the Mimosa Project, part of the European Union Framework Programmes for Research and Technological Development.

The SSI protocol is used in point-to-point communications over UART and networking nanoIP applications. SSI also provides polling sensors and streaming sensor data. For RFID sensor tags SSI specifies memory map for sensor data.

The criteria for SSI protocol development are:

- general purpose
- simple – minimal overhead
- small footprint on the server (sensor) side

4.12. Power supply

The power supply circuit. It's based on 3 terminal voltage regulators, which provide the required regulated +5V and unregulated +12V. Power is delivered initially from standard 12V AC/DC adapter or 12V_500ma Transformer. This is fed to bridge rectifier (D3, 4, 5, 7) the output of which is then filtered using 1000uf electrolytic capacitor and fed to U5 (voltage regulator). U5 +5V output powers the micro controller and other logic circuitry. LED L2 and its associate 1K current limiting resistors provide power indication. The unregulated voltage of approximately 12V is required for GPS and GSM Modem and relay, buzzer driving circuit. A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

All power supplies have a power input connection, which receives energy in the form of electric current from a source, and one or more power output connections that deliver current to the load. The source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells, generators or alternators, solar power converters, or another power supply. The input and output are usually hardwired circuit connections, though some power supplies employ wireless energy transfer to power their loads without wired connections. Some power supplies have other types of inputs and outputs as well, for functions such as external monitoring and control. Power supplies are categorized in various ways, including by functional features. For example, a regulated power supply is one that maintains constant output voltage or current despite variations in load current or input voltage. Conversely, the output of an unregulated power supply can change significantly when its input voltage or load current changes. Adjustable power supplies allow the output voltage or current to be programmed by mechanical controls (e.g., knobs on the power supply front panel), or by means of a control input, or both. An adjustable regulated power supply is one that is both adjustable and regulated. An isolated power supply has a power output that is electrically independent of its power input; this is in contrast to other

power supplies that share a common connection between power input and output. The power supply of an electrical system tends to generate much heat. The higher the efficiency, the more heat is pulled away from the unit. There are many ways to manage the heat of a power supply unit. The types of cooling generally fall into two categories -- convection and conduction. Common convection methods for cooling electronic power supplies include natural air flow, forced air flow, or other liquid flow over the unit. Common conduction cooling methods include [heat sinks], cold plates, and thermal compounds. Power supplies often have protection from short circuit or overload that could damage the supply or cause a fire. Fuses and circuit breakers are two commonly used mechanisms for overload protection. A fuse contains a short piece of wire which melts if too much current flows. This effectively disconnects the power supply from its load, and the equipment stops working until the problem that caused the overload is identified and the fuse is replaced. Some power supplies use a very thin wire link soldered in place as a fuse. Fuses in power supply units may be replaceable by the end user, but fuses in consumer equipment may require tools to access and change. A circuit breaker contains an element that heats, bends and triggers a spring which shuts the circuit down. Once the element cools, and the problem is identified the breaker can be reset and the power restored. Some PSUs use a thermal cut-out buried in the transformer rather than a fuse. The advantage is it allows greater current to be drawn for limited time than the unit can supply continuously. Some such cut-outs are self resetting, some are single use only. Some supplies use current limiting instead of cutting off power if overloaded. The two types of current limiting used are electronic limiting and impedance limiting. The former is common on lab bench PSUs, the latter is common on supplies of less than 3 watts output. A fold back reduces the output current to much less than the maximum non-fault current.

4.13. PCB making

The performance of an electronic circuit depends upon layout and design of Printed Circuit Board (P.C.B.) .Modern electronic system would be virtually impossible to package without incorporating circuit into their design. Printed circuit board having excellent peel strength and conductance resistance is provided with a substrate, a resin insulating layer formed thereon and roughened at its surface, and a conductor formed thereon, in which at least a portion of the conductor is composed of an eutectic metal layer.

A printed circuit board, comprising: a substrate; a resin insulating layer comprising a roughened surface on said substrate, said resin insulating layer comprising an adhesive layer formed by dispersing heat-resistant resin powder having a particle size of not greater than 10 .mum and soluble in an oxidizing agent into a heat resistant-resin which is hardly soluble in the oxidizing agent, said roughened surface comprising anchor recesses formed by dissolving said heat-resistant resin powder in the oxidizing agent; and a conductor circuit on said resin insulating layer, a portion of a conductor in said conductor circuit at least facing said roughened surface inclusive of said anchor recess is composed of an eutectic metal.

Two technologies are described to manufacture bare circuit boards. Both methods are dry processes and are additive by nature. The first technology is a process whereby circuit lines are written directly onto the substrate from a CAD/CAM database. There is no need for artwork to be generated with its inherent limitations. A circuit board is manufactured by applying a film of heat-sensitive adhesive to a substrate and depositing on the film a layer of conductive powder. The powder and film are then activated by laser radiation to define the circuitry. The excess powder is then removed and the substrate fired to cure or bond the powder to the substrate. The second technology is directed toward higher-volume production and requires the use of a master pattern. The fundamental principles involved are well understood in the photocopying field. The master pattern consists of a conductive base on which there is a pattern layer. The master pattern is also easily created by direct laser writing. The pattern layer receives an electrostatic charge. The master pattern is contacted by a developer containing a conductive material in the form of a powder or ink and which transfers the conductive material to the pattern by electrostatic force. A substrate is then brought to a position closely adjacent to the master pattern and electrostatic force is used to deposit the particles from the pattern onto the substrate to accurately define the circuitry. The particles are then fixed by heating

Eagle (Easily Applicable Graphical Layout Editor):

The EAGLE is an editor, which is easy-to-use, yet powerful tool for designing printed circuit boards (PCBs). It is a complete platform for the development of any type of complicated & sophisticated multilayered PCBs. This software consists of the following tools:

Schematic Editor:

In this one can develop & design circuits for the required PCB.

Layout Editor:

In this one can develop & design actual PCB structure required. This is done automatically by the software using the circuit in the schematic editor itself.

Library Editor:

This is very useful in case of customized component design that does not occur in the predefined library according to our need.

Auto Router:

This is an artificial intelligence based tool or subroutine that can do auto routing of the PCB tracks designed.

Cam Processor:

This is used to finally print the various layers of the designed PCB viz. Top Layer, Bottom Layer, Component Layer, Masking Layer etc.

Developing The PCB:-**PATTERNING (ETCHING):-**

The vast majority of printed circuit boards are made by adhering a layer of copper over the entire substrate, sometimes on both sides, (creating a "blank PCB") then removing unwanted copper after applying a temporary mask (eg. by etching), leaving only the desired copper traces. A few PCBs are made by adding traces to the bare substrate (or a substrate with a very thin layer of copper) usually by a complex process of multiple electroplating steps.

LAMINATION:-

Some PCBs have trace layers inside the PCB and are called multi-layer PCBs. These are formed by bonding together separately etched thin boards.\

DRILLING:-

Holes, or vias, through a PCB are typically drilled with tiny drill bits made of solid tungsten carbide. The drilling is performed by automated drilling machines with placement controlled by a drill tape or drill file. These computer-generated files are also called numerically controlled drill (NCD) files or "Excellent files". The drill file describes the location and size of each drilled hole.

When very small vias are required, drilling with mechanical bits is costly because of high rates of wear and breakage. In this case, the vias may be evaporated by lasers. Laser-drilled vias typically have an inferior surface finish inside the hole. These holes are called micro vias. It is also possible with controlled-depth drilling, laser drilling, or by pre-drilling the individual sheets of the PCB before lamination, to produce holes that connect only some of the copper layers, rather than passing through the entire board. These holes are called blind vias when they connect an internal copper layer to an outer layer, or buried vias when they connect two or more internal copper layers. The first step is to design the schematics in a PCB Layout Editor such as EAGLE. After the schematic is entered, the PCB layout program is used to place the parts on the board and route the copper traces. After the first few parts are mounted, the "rats nest" begins to clear up. If you're lucky, you get a PCB that requires no external jumper wires. When the layout is done, the board layers are printed onto special toner transfer paper with a laser printer. This board "image" is transferred to the bare copper board with a laminating machine, or a hot clothes iron. After laminating, the board with the paper stuck to it is soaked to remove the paper, leaving only the toner behind. After etching, the toner is removed with solvent and the board is tinned using a soldering iron and a small piece of tinned solder wick. Tinning isn't absolutely necessary but it improves the appearance of the board, and prevents the copper from oxidizing before it's time to solder the parts to the board. Then holes are drilled for any leaded components and mounting holes. After completing this completed board ready to be populated.

4.13.1. PCB Etching

PCB ETCHING/PCB PROTOTYPING

1. PCB ETCHING

2. CREATING PCBs WITH THE TONER TRANSFER METHOD

3. PCB PROTOTYPING

These three are same thing to make prototype of PCB.

If you take your electronics hobby seriously, I guess you already feel the need for a simple and fast technique for making your own printed-circuit boards (PCB). **Here I'm going to show how to make simple single-sided PCBs in a snap**, using widely available materials. This technique works reliably for thin tracks down to 10 mils, and is also suitable for most surface-mount parts.

WHAT YOU NEED:-

1. Magazines or advertising brochures.
2. Laser printer.
3. Household clothes iron.
4. Copper clad laminate.
5. Etching solution.
6. Kitchen scrubs.
7. Thinner (e.g. acetone)
8. Plastic coated wire.

You need also: a blade cutter, scotch tape, sandpaper, kitchen paper, cotton wool, vice, hacksaw.

HOW IT WORKS:-

Laser printers and photocopiers use plastic toner, not ink, to draw images. Toner is the black powder that ends up on your clothes and desk when replacing the printer cartridge. Being plastics, toner is resistant to etching solutions used for making PCBs – if only you could get it on copper!

Modifying a printer for working with copper is out of question, but you can work around it with the toner-transfer principle. Like most plastics, toner melts with heat, turning in a sticky, glue-like paste. So why not print on paper as usual, place the sheet face-down on PCB copper, and melt toner on copper applying heat and pressure?

Almost right. Right now you got paper toner-glued to PCB copper. Last step is to find a way to remove paper leaving toner on **the copper, and you're done.**

inkjet photo paper in his laser printer. i found that the glossy coating dissolves in water. As most of the toner does not penetrate the glossy surface, you can easily remove the paper support with water: the gloss dissolves and you can remove paper.

Clever, isn't it?

While searching for more information on the subject, suggested replacing expensive inkjet photo paper with glossy paper recycled from magazines. Magazines use ink, not toner, for printing, so previous printing shouldn't affect the process. Another

great idea! I tried it and worked so well that I decided to spread the word. Read on for a complete tutorial and my hands-on tips.

FINDING THE RIGHT PAPER:-

I discard pages heavily printed, preferring pages with normal-size text on white background. Although ink usually does not transfer on the PCB, heavy print of headlines sometimes accumulate so much ink that some gets on copper.

Cut the paper to a size suitable for your printer. Try to get straight, clean cuts, as jagged borders and paper dust are more prone to clog printer mechanism. An office cutter is ideal, but also a blade-cutter and a steady hand work well. Be careful to **remove all staples, bindings, gadget glue or similar stuff, as they can damage printer's drum and mechanisms.**

PRINTER SETUP:-

Laser printers are not designed for handling thin, cheap paper, so we must help them feeding the sheets manually instead of using the paper tray. Selecting a straight paper path minimizes the chances of clogging. This is usually achieved setting the printer as if it were printing on envelopes. You want to put as much toner on paper as **possible, so disable "toner economy modes" and set printer properties to the maximum contrast and blackness possible.** You want to print your PCB to exact size, so disable any form of scaling/re-sizing (e.g. "fit to page"). **If your printer driver allows, set it to "center to page" as it helps to get the right position using a non-standard size sheet.**

PRINTING:-

Print your PCB layout as usual, except you must setup the printer as described above and you must print a mirrored layout. This is my PC thermometer circuit printed on magazine paper. Notice that it is a mirror image of the circuit (the word PCTHERM is reversed).

Placing some text helps recognizing when the layout is mirrored. Text will read straight again once the image is transferred on copper. If you look it very closely, you can see that toner is not opaque enough to 100% cover the words underneath, but this **won't affect etching.**

HOW TO CUT RAW MATERIAL:-

PCB material is fiberglass like, and a trick to cut it effortlessly is to score a groove with a blade cutter or a glass cutter. The groove weakens the board to the point that bending it manually breaks it along the groove line. This method is applicable only **when cutting the whole board along a line that goes from side to side, that is you can't cut a U or L shaped board with it.** For small boards, I lock the PCB material in a vice, aligning vice edge and cut line. I use an all-aluminum vice which is soft and **doesn't scratch copper, if you use a steel vice protect copper surface with soft material.**

Using the vice as a guide, I score BOTH board sides with a blade cutter (be careful) or another sharp, hardened tool (e.g. a small screwdriver tip). Ensure to scratch edge-to-edge. Repeat this step 5-6 times on each side. Bend the board. If groove is deep enough, the board will break before reaching a 30 degrees bend. It will break quite abruptly so be prepared and protect your hands with gloves. To make paper alignment easier, cut a piece of PCB material that is larger (at least 10mm/0,39 inch for each side) than the final PCB.

CLEANING THE BOARD FOR TONER TRANSFER:-

It is essential that the copper surface is spotlessly clean and free from grease that could adverse etching. To remove oxide from copper surface, I use the **abrasive spongy scrubs sold for kitchen cleaning. It's cheaper than ultra-fine sandpaper** and reusable many times. Metallic wool sold for kitchen cleaning purposes also works. Thoroughly scrub copper surface until really shiny. Rinse and dry with a clean cloth or kitchen paper.

PREPARING FOR TRANSFER:-

To make paper alignment easy, cut excess paper around one corner (leave a small margin though). Leave plenty of paper on the other sides to fix the paper to the desk. As the board is larger than the final PCB, there is large margin for easy placement of paper on copper.

Turn the iron to its maximum heat (COTTON position) and turn off steam, if present. While the iron warms up, position the **materials on the table. Don't work on an ironing board as its soft surface** makes it difficult to apply pressure and keep the PCB in place. Protect table surface with flat, heat-resistant material (e.g. old magazines) and place the board on top, copper face up. Lock the board in place with double-adhesive tape. Position the PCB printout over the copper surface, toner down, and align paper and board corners. Lock the paper with scotch tape along one side only. This way, you can flip the paper in and out instantly.

IRON IT! :-

Flip out the paper, and preheat copper surface placing the iron on top of it for 30 seconds. Remove the iron, flip back paper into its previous position over the copper. It is essential that paper does not slip from its position. You can also cover with a second sheet of blank paper to distribute pressure more evenly. Keep moving the iron, while pressing down as evenly as you can, for about one minute.

Remove the iron and let the board to cool down.

PEELING:-

When the board is cool enough to touch, trim excess paper and immerse in water. Let it soak for 1 minute, or until paper softens.

Cheap paper softens almost immediately, turning into a pulp that is easy to remove rubbing with your thumb. Keep rubbing **until all paper dissolves (usually less than 1 minute). Don't be afraid to scratch toner, if it has transferred correctly it forms a very strong bond with copper.**

The board with all paper removed. It is OK if some microscopic paper fibers remain on the toner (but remove any fiber from copper), giving it a silky feeling. It is normal that these fibers turn a little white when dry.

THE HANGER TOOL:-

The optimal way to etch is keeping the PCB horizontal and face-down (and possibly stirring). This way dissolved copper gets rapidly dispersed in the solution by gravity. Stirring keeps its concentration even, so the solution close to the PCB does not saturate and etching proceeds quicker. Unfortunately it is not easy to keep the PCB in place in a highly corrosive acid. This hanger is my best attempt to solve the problem. I made it with plastic-insulated copper wire. The wire must have a rigid core, but must be also easy enough to adapt to the board by hand without tools. Core diameter of 1 to 2mm is fine. Give it the form of an "arm" (the handle) ending with 4 "fingers".

Each finger has a ring tip that fits a corner of the board. Close fingers around board corners: now you can use the handle to splash the board into the etching solution, stir, and inspect how etching proceeds.

ETCHING:-

There are many alternatives for etching liquids, and you can use the one that suits your taste. I use ferric chloride (the brown stuff): **it's cheap, can be reused many times, and doesn't require heating. Actually, moderate heating can speed up etching, but I find it reasonably fast also at room temperature (10...15 minutes).**

The down side of **this stuff** is that **it's incredibly messy. It permanently stains everything it gets in contact with: not only clothes or skin (never wear your best clothes when working with it!), but also furniture, floor tiles, tools, everything. It is concentrated enough to corrode any metal – including your chrome-plated sink accessories. Even vapors are highly corrosive: don't forget the container open or it will turn any tool or metallic shelf nearby into rust.**

For etching, I place the container on the floor (some scrap cardboard or newspaper to protect the floor from drops). I fit the board on the hanger, and submerge the PCB. Stir occasionally by waving the hanger.

First impression may be that nothing happens, but in less than 10 minutes some copper is removed, making first tracks to appear. **From now on, stir continuously and check often, as the process completes rather quickly. You don't want to overdo it,**

otherwise thinner tracks start being eroded sideways. As a rule of thumb, stop 30 seconds after you don't see any copper leftovers over large areas.

Rinse the board with plenty, plenty, plenty of water

I store the etching solution in the same plastic box used for etching. When the job is done I just put the hermetic lid on. To further minimize risks of leakage, I put the container inside the bigger one I use for rinsing, put the second lid, and store it in a safe place.

Disclaimer:- These are dangerous chemicals. Always read the labels that come with the solution, handle it wearing protective gloves and goggles, keep windows open, don't inhale the fumes.

FINISHING TOUCHES:-

A few drops of thinner (nail polish remover works well) on a pinch of cotton wool will remove completely the toner, bringing back the copper surface. Rinse carefully and dry with a clean cloth or kitchen paper.

Trim to final size and refine edges with sandpaper.

SOLDER IT:-

Now your PCB is ready to use.

5. Software Requirement

In this chapter we shall talk about the software which will be used for the testing and execution of the project. They are as follows:

- 5.1. Eagle CAD for PCB Designing.
- 5.2. Embedded "C" Compiler for MCU Programming.
- 5.3. Proteus for Circuit Simulation.

5.1. Eagle CAD for PCB Designing

EAGLE is a scriptable electronic design automation (EDA) application with capture, printed circuit board (PCB) layout, auto-router and computer-aided manufacturing (CAM) features. EAGLE stands for Easily Applicable Graphical Layout Editor and is developed by Cad Soft Computer GmbH.

EAGLE contains a schematic editor, for designing circuit diagrams. Schematics are stored in files with .SCH extension; parts are defined in device libraries with .LBR extension. Parts can be placed on many sheets and connected together through ports. The PCB layout editor stores board files with the extension .BRD.

It allows back-annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic. EAGLE saves Gerber and PostScript layout files as well as Excellent and Sieb & Meyer drill files.

These are standard file formats accepted by PCB fabrication companies, but given EAGLE's typical user base of small design firms and hobbyists many PCB fabricators and assembly shops also accept EAGLE board files (with extension .BRD) directly to export optimized production files and pick-and-place data themselves. EAGLE provides a multi-window graphical user interface and menu system for editing, project management and to customize the interface and design parameters.

The system can be controlled via mouse, keyboard hotkeys or by entering specific commands at an embedded command line. Multiple repeating commands can be combined into script files (with file extension .SCR). It is also possible to explore design files utilizing an EAGLE-specific object-oriented programming language (with extension .ULP).

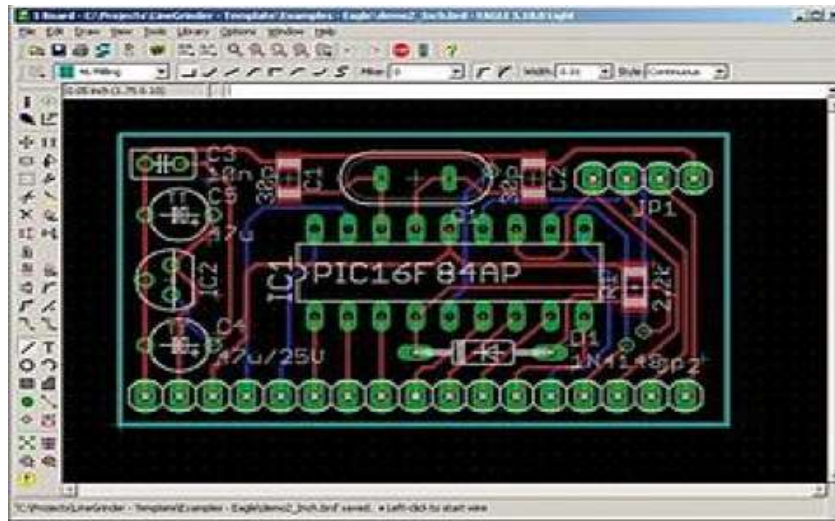


Figure 5.1. Eagle CAD for PCB Designing

5.2. Embedded C compilers

Embedded C++ (EC++) is a dialect of the C++ programming language for embedded systems. It was defined by an industry group led by major Japanese central processing unit (CPU) manufacturers, including NEC, Hitachi, Fujitsu, and Toshiba, to address the shortcomings of C++ for embedded applications. The goal of the effort is to preserve the most useful object-oriented features of the C++ language yet minimize code size while maximizing execution efficiency and making compiler construction simpler. The official website states the goal as "to provide embedded systems programmers with a subset of C++ that is easy for the average C programmer to understand and use". The language has had a poor reception with many expert C++ programmers. In particular, [Bjarne Stroustrup](#) says, "To the best of my knowledge EC++ is dead (2004), and if it isn't it ought to be." In fact, the official English EC++ website has not been updated since 2002. Nevertheless, a restricted subset of C++ (based on Embedded C++) has been adopted by Apple, Inc. as the exclusive programming language. Embedded C is actually the extension of C language. It consists of C language sets that can be used for different purposes. It was extended by the standard committee C in 2008 for solving the issues provided by C language. It mostly used the syntax and standard C semantics. This language has so many features as compared to C language such as it used the fixed point arithmetic, spaces between memory address and hardware input, output addressing. As we look around ourselves, we have so many embedded systems such as washing machine, digital camera and mobile phones all these are examples of embedded systems, in all these things embedded C language is used. So many extra characteristics have been added in embedded C such as operation or mapping register, number of memory area and representation of fixed point. It is only the extension of C language and nothing more.

It has source code format that depends upon the kind of microcontroller or microprocessor that have been being used. Through embedded C high level optimization can be done. It is used in microprocessor or microcontroller applications.

It has limited resources for use, meaning the embedded system has only memory location. In embedded C constraints run on real time and output is not available at the operating system. It only supports the adequate processor or controller.

In embedded C only pre-defined programs can run. It requires a compiler of embedded C, which has compatibility with all the embedded system resources. Some of the examples of embedded system C applications are digital camera, DVD and digital TV etc. The major advantage of embedded C is its coding speed and size is very simple and easy to understand. It is easier to understand. It performs the same task all the time so there is no need of any hardware changing such as extra memory or space for storage. It performs only one task at one time meaning it is purposed for the dedicated task. Hardware cost of embedded C systems are usually so much low. Embedded applications are very suitable for industrial purposes.

5.3. Proteus for Circuit Simulation

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards. The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design. It also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as a training or teaching tool. Product Modules. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. The PCB Layout module is automatically given connectivity information in the form of a netlist from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. Design Rule Checking does not include high speed design constraints.

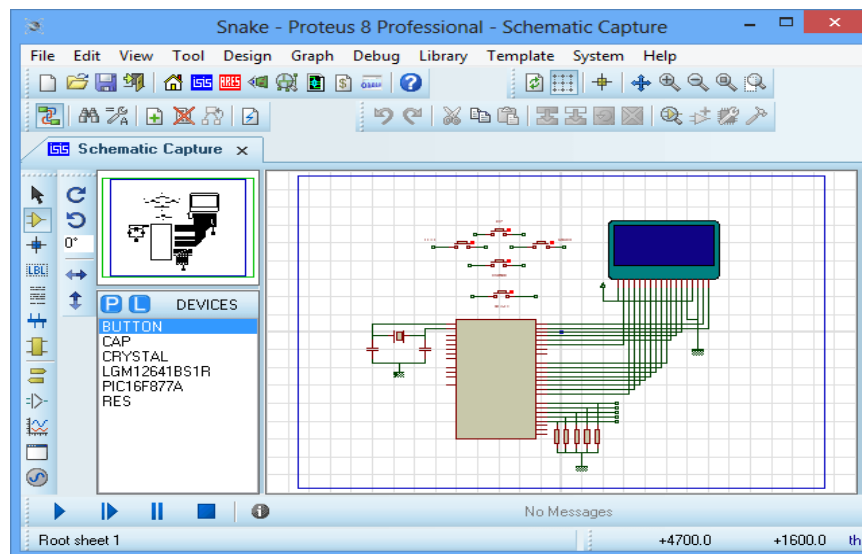


Figure 5.3. Proteus for Circuit Simulation

6. Advantages and Disadvantages

6.1. Advantages

The design is very cost effective for mass production purposes. It has a potential of being a modular device which implies there can be multiple features added to it for safety and recreational purposes. Improves the probability of the user surviving a potentially fatal accident. Helps the user be more alert of their surroundings while in motion. Makes communication easy and sending distress alerts is convenient. Parts are easy to acquire and technology is widely available with mobile networks and high speed internet is available at fairly affordable prices for the general population. Proposed network can be further made wireless to improve mobility and reduce weight. Similarly various upgrades can be carried out to accommodate multiple features.

6.2. Disadvantages

In order to keep the cost low and affordable to the masses, the device misses out on a few more safety features that can be added to it. Camera support, proximity alert, sleep detection, etc. Transport regulations in the country currently do not support the branching out of the smart helmet into something that is used as a source of information while commuting.

7. Future Scope & Conclusion

Future Scope

The safety potential of a helmet can be increased drastically with the help of technology and that is not restricted to just the on-road use of the device. Its dynamic nature shall help us improve the functioning of a number of industries namely, the military and armed forces, firefighting departments and also it would change a lot of things in the sports industry. This Heads Up Display technology that has now been incorporated in a number of future automotive concepts can also be incorporated to the smart helmet, this opens up the device to new research and development opportunities in the Augmented Reality sector which is on the rise. We can implement various bioelectric sensors on the helmet to measure various activities. We can use small camera for the recording the driver's activity. It can be used for passing message from the one vehicle to another vehicle by using wireless transmitter. We have used solar panel for helmet power supply by using same power supply we can charge our mobile.

Conclusion

With the help of the helmet itself we could reduce road mishaps to great extent. Thus the components are selected in order to make safety helmet system based on embedded. Various data regarding to components is studied. The components are fixed according to application. By minimization of all the components the size and weight of the system can be reduced to a much comfortable level. The alcohol detection plays the vital role in accident reduction as many of cases happen due to consumption of alcohol. Not only detecting alcohol but also instant message system of sending user location to the police and hospitals will contribute a lot to save life as the medical facility will be provided as earliest as possible.

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Journal paper,

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Atharva College of Engineering Department of Electronics Weekly Progress Report							
Date	Activity	Outcome	Comment on Outcome	Resources Utilized	Next Meeting Date	Target	Guide Remark
26 th July 2019	Searching for appropriate domain that suits the knowledge and abilities of all the group members	Finalized the domain	Target is completed	Computer lab	10th August 2019		

10th August 2019	Searching for Final year project topics and ideas and coming up with 3 topics that belong to the Selected domain.	Finalized 3 project topics and obtained research papers on the Same.	Target is completed	IEEE Journal, IEEE Spectrum, International Journals & Publications.	14th August 2019	3 projects topic Finalized.	
14th August 2019	Proposed 3 finalized project topics to the project guide and project Coordinator.	Topic of final year project decided "Intelligent Safety Helmet System"	Target is completed	Computer lab	17th August 2019	Final year project topic confirmed and Work begun.	
17th August 2019	Understanding the actual flow of project and which components are going to be used	Flow chart of the project is made & the components Are decided.	Target is completed	Computer lab	23rd August 2019	Flow chart is Made.	
23 rd August 2019	Understanding the microcontroller 'ATMEGA8' and various Sensors.	Specification s of 'ATMEGA8' studied & various sensors were observed	Target is completed	Datasheets, Computer lab	30th August 2019	Specifications of ATMEGA8an d sensors are Studied.	
19th September 2019	Presentation of the project in front of faculty of Electronics Dept. and submission of the project Synopsis. Answering the doubts & queries of the faculties regarding the	Project synopsis is submitted and presentation of the project is completed	Target is completed	Microsoft Word and PowerPoint, Computer Lab.	26th September 2017	Submitted the synopsis and presented the Project.	

	project						
6th SEPTEMBER 2019	Learning Eagle CAD for PCB Designing and Proteus for Circuit Simulation.	Learnt how to create Programs on Eagle CAD.	Target is completed	YouTube tutorials and computer lab	13th September 2019	Learnt how to use Eagle CAD for PCB Designing and Proteus for Circuit Simulation.	
13th September 2019	Studying the entire flow of the system and designing it in form of flow diagram	Learnt the flow of the system and the designing is made	Target is completed	Microsoft word, computer lab	20th September 2019	Flow diagram is made and studied	
10th October 2019	Report, present making and showing softcopy to project guide for any correction	Submitting softcopy of ppt and report	Target is completed	Microsoft Word and PowerPoint, Computer Lab	18th October 2019	Report and ppt completion	
25th October 2019	Final ppt presentation and submitting hardcopy of Report	Project report and ppt presentation is given	Target is completed	Computer lab	-----	Hardcopy submission of report and ppt presentation	